REMARKS

1. Summary of the Office Action

Claims 1-6, 10, and 17-18 stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taylor (USPN 5,982,305) in view of Applicant's admitted prior art. Claims 7-9, 11-16, and 19-33 stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taylor in view of Applicant's admitted prior art, and further in view of Orban (USPN 6,337,999). These rejections are respectively traversed.

2. Response to § 112 Rejection

Claims 15 and 26 have been amended and it is submitted that the objection under 35 U.S.C. 112, second paragraph, has been overcome.

3. Response to § 103 Rejections

Claims 1-6, 10, and 17-18 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Taylor (USPN 5,982,305) in view of Applicant's admitted prior art.

Applicant respectfully traverses this rejection for the reasons set out below, and earnestly ask the Examiner for reconsideration.

To establish a **prima facie** case of **obviousness**, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the

reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

It is submitted that neither Taylor nor any of the prior art described in the present application disclose the limitation of claim 1 of "**dynamically varying** said input sample rate associated with said input signal to any one of the plurality of differing output sample rates **by interpolation with an interpolator having associated therewith a second transition band**, with the width associated with said second transition band being a function of a spectral separation of said first transition band and said image, and wherein a second signal is produced having a sequence of data samples approximating the input signal."

TAYLOR DOES NOT DYNAMICALLY VARY THE SAMPLE RATE

Claim 1 includes the limitation of "**dynamically varying** said input sample rate.... by interpolation with an interpolator having associated therewith **a second transition band**." It is submitted that neither Taylor nor any of the prior art described in the present application disclose this limitation. It will also be evident from the discussion below that Taylor only describes a **single transition band**.

Taylor merely describes a sample rate converter using the well-known steps of standard upsampling (interpolate), filtering (and thus a single transition band), and downsampling (decimate). Taylor is not able to cope with **dynamically variable** sample rate conversions. Nowhere in his specification do the words "varying" nor "variable" occur, nor does the word "vary" appear in the context of the sample rate. Indeed, in the section quoted in the Office Action (column 3 lines 2-6), Taylor states he changes a signal to "a different **specified** sample rate", indicating that the conversion is to a single rate known in advance, in stark contrast to one that is **dynamically varying**.

Numerous places in Taylor's specification make it clear that his invention does not contemplate dynamically varying the sample rate. To one skilled in the art, it should be clear that Taylor's output sample rate is the input rate multiplied by the ratio L/M. If Taylor were to dynamically vary the rate, which is strongly denied, Taylor would need to teach or suggest that L and/or M can be varied dynamically, which he clearly does not teach. Instead, Taylor tells us that L and M have particular static values. In column 7, lines 34-36, he states "[t]he particular value of L is selected (i.e., "tuned") for the particular filter that is selected for the converter." Similarly in column 8, lines 7-9, he says "[l]ike the interpolation factor L, the actual value of M is selected based on the particular predefined filter that is selected to perform the conversion." It is clear also that the filter remains fixed, for Taylor tells us in column 4, lines 23-25, "[b]ecause the invention utilizes a predefined filter, there is no need to recalculate, interpolate, or stage the filter at runtime."

In column 8, lines 37-40, Taylor makes it clear that only one input and output rate are anticipated for any conversion, stating "[a]t this step, a digital signal having a particular input sample frequency f_{INPUT} is identified, and a desired output sample frequency f_{OUTPUT} is selected." This is reiterated in column 14, lines 34-38, where Taylor states "the sample rate converter 100 can store the resulting output signal (y(m) in FIG. 2), which now has the desired sample rate f_{OUTPUT}, into any desirable computer memory location." There is nowhere any indication that either the input or output sample frequency can vary dynamically; it is very clear these frequencies are fixed for any particular conversion.

Taylor's Figure 3 demands this conclusion as well. This flowchart makes it clear that L and M have been fixed (tuned) in step 210 prior to entering processing loop (see dotted box 212), wherein the interpolate, filter, and decimate steps occur which perform the sample rate conversion. Figure 3 clearly precludes varying either L or M dynamically during the conversion process. Clearly Taylor does not describe the limitation of claim 1 wherein "**dynamically varying** said input sample rate associated with said input signal **to any one of the plurality of differing output sample rates**" and, in fact, teaches away from the present invention.

In view of the above, it is submitted that neither Taylor nor any of the prior art described in the present application describe the limitation of "**dynamically varying** said input sample rate associated with said input signal to any one of the plurality of differing output sample rates **by interpolation with an interpolator having associated therewith a second transition band.**"

TAYLOR DOES NOT DESCRIBE AN INTERPOLATOR HAVING ASSOCIATED THEREWITH A SECOND TRANSITION BAND.

It is submitted that the Office Action totally misconstrues the limitation in claim 1 of "dynamically varying said input sample rate associated with said input signal to any one of the plurality of differing output sample rates **by interpolation with an interpolator having associated therewith a second transition band.**"

In the cited prior art (including Taylor and Orban) the term "interpolating" is synonymous with inserting zero valued samples into the original signal to increase the effective sample rate (upsampling). This is also clearly evident from other literature such "Principles of Digital Audio" 4th Edition by Ken C. Pohlmann (see pages 96-99).

However, claim 1 includes the limitation of "**interpolation with an interpolator having associated therewith a second transition band**." Clearly, the mere insertion of zeros during prior art upsampling cannot even vaguely suggest an interpolator of this nature. Merely inserting a zero value into a digital signal can in absolutely no way disclose "a second transition band." Further, Taylor's "interpolation" function has no filter associated with it. Taylor, column 3 lines 14-23, clearly specifies that the interpolation, filtering, and decimation are separate functions. In column 7, lines 26-35, Taylor clearly explains that the interpolation function merely inserts L zero valued samples. Thus there is no filtering, and hence no transition band associated with Taylor's interpolation function. Clearly. Taylor does not disclose the limitation of "**interpolation with an interpolator having associated therewith a second transition band**" and those

skilled in the art would understand what is claimed when the claim is read as a whole and in the light of the specification.

In view of this total misunderstanding of the limitation, the Office Action erroneously purports that a digital input signal has inherently associated with it a "transition band". It is strongly submitted that this assertion is unacceptable to one skilled in the art. For example, a digital signal is provided at a given sampling frequency Fs. The limitations of digital signals are such that such a signal cannot contain any information higher than the associated Nyquist frequency, Fn = Fs/2, however frequencies above this limit are not generally referred to as within a "stopband." Based on similar limitations, it might be said that the "passband" of such a signal is from zero to the Nyquist frequency, Fn = Fs/2. Alternatively, based on convention (such as for digital audio sampled at 48 kHz) an arbitrary frequency limit below Fn might be selected as the highest useful signal (thus defining a "passband") and the remaining space within the Nyquist limit is referred to as a "guardband." This is explained in the first page of the specification.

However, it is important to note that the term "transition band" applies to filters, not to signals. One might, of course, design a filter to condition an incoming signal for conversion to digital format, and in this case it would be prudent to match the filter's characteristics to those of the conventions for the incoming signal. In this case, the "transition band" of the filter would be determined by the width of the "guardband." However, in a manner analogous to that discussed in the specification, pages 5 through 8, such a filter requires an "interpretation" of the guardband to decide if the transition band

should be designed to span the guardband alone, or the guardband and its image. It should be clear from the above that "guardband" is a term associated with a convention associated with a type of signal, and is not synonymous with "transition band" which applies to a filter. Thus the Office Action is clearly wrong in alleging that a **signal** has parts including a passband, a guardband and a stopband. These are parts of a **filter, or a system containing a filter**, and not part of a signal itself.

Furthermore, if it is incorrectly assumed that a signal has an "inherent" transition band associated with it because of the presence of a guardband which might guide the design of a filter, such a transition band and its image are by their very nature adjacent or even overlapping, hence having no spectral separation. Hence it is meaningless in this case to attempt to use such an interpretation in the later part of the claim in which the second transition band's width is associated with this spectral separation.

In summary, it is strongly submitted that the argument in the Office Action that there is a transition band inherently associated with an input signal is clearly wrong and untenable to one skilled in the art. It clearly follows from the above that the conclusion in the Office Action on page 5 is clearly incorrect and that the limitation of "dynamically varying said input sample rate associated with said input signal to any one of the plurality of differing output sample rates **by interpolation with an interpolator having associated therewith a second transition band**" is NOT disclosed or even vaguely suggested in Taylor.

Still further to the above, the Office Action then argues that one skilled in the art would, based on prior art cited within the present application, make the width of the

second transition band based on the spectral separation of the first transition band and its image. In the context raised in the Office Action this cannot be correct, as there is no inherent transition band associated with the incoming signal. Furthermore, Taylor never operates on the incoming signal in such a way to associate a transition band therewith. The only operation Taylor does before filtering (bearing in mind that Taylor's filter, according to the Office Action, is that which has the second transition band) is to "interpolate" the signal by inserting zero valued samples. Inserting zeroes cannot have a transition band; the effect of insertion of L zeroes on the spectrum of a signal is to simply move the sample rate and corresponding Nyquist frequency by a factor of L. Thus Taylor has neither a first transition band nor an image thereof to design to.

In view of the above it is strongly submitted that claim 1 is allowable. As claims 2-11 are dependent upon claim 1 they are also allowable.

Claim 17 includes the limitation of "code for dynamically varying said input sample rate associated with said signal to any one of the plurality of differing output sample rates by interpolating a subset of data points of said plurality of data points with an interpolator having associated therewith a second transition band, with the width associated with said second transition band being a function of a spectral separation of said first transition band and said image, and wherein a second signal is produced having a sequence of data samples approximating the input signal."

In view of the remarks above regarding claim 1, it is strongly submitted that claim 17 is also allowable. As claims 18-22 are dependent upon claim 17 they are also allowable.

In rejecting claims 12 and 23, the Office Action refers "to the like teachings of Claim 1, 6, and 7." In view of the discussion above, it will be appreciated that Taylor does not describe halfband filtering followed by **interpolation**.

Further, claims 12 and 23 include the limitation of "interpolating the intermediate data points with an interpolator having independently programmable parameters, and **wherein the different sample rate is provided by interpolating at least a subset of the intermediate data points based on the independently programmable parameters.**" Taylor does not disclose or even suggest "**interpolating at least a subset** of the intermediate data points."

In view of the above it is strongly submitted that claims 12 and 23 are also allowable. As claims 13-6 and 24-33 are dependent upon claims 12 and 23 respectively, they are also allowable.

In light of the above, Applicant respectfully submits that the rejections under 35 U.S.C. § 103 have been overcome, and withdrawal of the rejections is therefore respectfully requested.

4. Office Action's Response to Previous Amendment

In the Office Action the Examiner has disagreed regarding the Applicant's interpretation of the interpolator in the system of Orban. In support of this, the Office action refers to column 3, lines 7-12 of Orban that states the upsampler of the basic form can be a prior art upsampler well known in the art. It is important to note that Orban uses the word "upsampler" exclusively to refer to padding extra samples (see column 3, lines

7-12). Thus, in Orban (and Taylor) the words "interpolator" and "upsampler" are used exclusively to refer to the insertion of zero values.

In the description of the prior art by the applicant, the Applicant describes upsampling as the insertion of zero values followed by filtering (see page 2 lines 8-15 of the replacement specification). Clearly the words are used in totally different context. Combining the words "upsample" and "interpolation" using their meaning, as defined by Orban (i.e. inserting zero values), with the background provided by the Applicant provides nothing more than what is already in the background i.e. insertion of zero values followed by a filter. It in no way teaches the limitations in the claims of "**varying** said input sample rate associated with said input signal to any one of the plurality of differing output sample rates by **interpolation with an interpolator having associated therewith a second transition band**." Further, if it is erroneously argued that the interpolator of the present invention is disclosed by the upsampler 20 of Orban, then the preceding limitation of the present invention of "operating on said plurality of data points to associate said input signal with a predetermined set of parameters, with said set of parameters including a first transition band having an image corresponding thereto" is no longer disclosed.

In view of the above it is submitted that neither Orban nor Taylor describes all the limitations of the present claims.

5. Conclusion

Having tendered the above remarks and amended the claims as indicated herein, Applicant respectfully submits that all rejections have been addressed and that the claims are now in a condition for allowance, which is earnestly solicited.

If a telephone interview would in any way expedite the prosecution of the present application, the Examiner is invited to contact André Marais at (408) 947-8200 ext. 204.

Respectfully submitted,
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